(54) APPARATUS FOR OBTAINING A CONTROL SIGNAL FROM AN INVERTER

(71) We, SCRAGG POWER DRIVES LIMITED, of P.O. Box 16, Sunderland Street, Macclesfield, Cheshire, a British Company, do hereby declare the invention, for which
5 we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an apparatus for
10 deriving a D.C. control signal from a D.C. to a.c. inverter that may be used in a speed control system for an induction motor.

When load current from an inverter to an induction motor has been measured as an
15 a.c. signal, after rectification, the resulting D.C. signal was generally representative of an average value of all the frequency components present in the inverter load current, typically the 5th, 7th and 11th harmonics,
20 as well as the fundamental frequency. Also, there may have been pulse-width modulation, at a much higher frequency, present in this a.c. signal, such modulation being used to control inverter output voltage. We have
25 discovered that performance of an induction motor essentially depends upon the fundamental frequency component of the real load current of an inverter.

According to the present invention a D.C.
30 to a.c. inverter comprises a bridge circuit of switching devices connected between a power supply rail of one polarity and an intermediate rail, current measuring means connected between the intermediate rail and
35 a power supply rail of the other polarity and a semi-conductor diode connected from a respective inverter output, about each of the switching devices and to one of the power supply rails to pass back electro-motive
40 forces generated by an inductive inverter load; the current measuring means deriving a unidirectional signal voltage from the current flowing solely in the switching devices, said signal voltage being proportional
45 to the root mean square value of the fundamental frequency component of the real load current of the inverter.

In one application of the invention, the

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inverter produces a multi-phase power supply for an induction motor and the derived 50 unidirectional signal voltage is used in a feedback loop to a speed control circuit driving the inverter.

The invention is illustrated, by way of example, on the accompanying drawing in 55 which:—

Fig. 1 is a circuit diagram of an inverter, and

Fig. 2 is a graph of D.C. control signal plotted against root mean square value of 60 load current from the inverter of Fig. 1.

As shown in Fig. 1, the inverter 1 consists of six power transistors T_1 to T_6 (acting as switching devices) connected in a bridge circuit between a positive power 65 supply rail 2 and a first intermediate negative rail 3. Silicon control rectifiers (thyristors) could be used instead of the transistors. The transistors are triggered sequentially, by a control circuit (not shown) 70 connected to the bases of the transistors to synthesise a three-phase voltage waveform between the outputs A, B and C.

Diodes D_1 to D_3 are reverse connected in parallel with a respective one of the tran- 75 sistors T_1 to T_3 and diodes D_4 to D_6 are reverse connected between the collectors of transistors T_4 to T_6 and a second intermediate rail 4 (distinct from rail 3).

A resistor S_1 is connected between the 80 intermediate rail 3 and the negative power supply rail 5 for the inverter. Similarly, another resistor S_2 is connected between the intermediate rail 4 and the negative power supply rail 5. 85

In use, the inverter is connected to a load, particularly to drive an induction motor such as a squirrel cage motor (not shown).

We have found that the current flowing in 90 intermediate negative rail 3, i.e. the current flowing solely through the transistors T_1 to T_6, is proportional to the root means square value of the fundamental frequency component of the real load current from the 95 inverter. This current is conveniently

measured as a unidirectional signal voltage, V_1, across the shunt resistor S_1.

The voltage V_1 is used as a first D.C. control signal in a feedback loop to a speed control circuit (not shown) for the inverter.

The current flowing in the intermediate rail 4, *i.e.* the current flowing through the diodes, is due to back electro-motive forces generated by an inductive load and by-passing the transistors.

Coils can replace the shunt resistors S_1 and S_2, the magnetic fluxes generated being proportional to the currents in each intermediate rail 3, 4. Hall effect plates may be used to accurately measure these magnetic fluxes and hence the currents.

The graph of Fig. 2 shows how accurately the measured potential V_1, across shunt resistors S_1, is representative of the root means square value of the fundamental frequency component of the real load current I_1, of a typical inverter driving an induction motor. The measured points x, y and z were observed respectively at 33%, 67% and 100% modulation. As can readily be seen, this modulation has no significant effect on the potential V_1, which is a linear function of I_1.

WHAT WE CLAIM IS:—

1. A D.C. to a.c. inverter comprising a bridge circuit of switching devices connected between a power supply rail of one polarity and an intermediate rail, current measuring means connected between the intermediate rail and a power supply rail of the other polarity and a semi-conductor diode connected from a respective output of the inverter, about each of the switching devices and to one of the power supply rails to pass back electro-motive forces generated by an inductive inverter load; the current measuring means deriving a unidirectional signal voltage from the current flowing solely in the switching devices, said signal voltage being proportional to the root mean square value of the fundamental frequency component of the real load current of the inverter.

2. An inverter as claimed in claim 1, in which the current measuring means is a shunt resistor, the voltage drop across the resistor being the signal voltage.

3. An inverter as claimed in claim 1, in which the current measuring means is an inductive coil, the magnetic flux from the coil being transformed by a Hall-effect plate into the signal voltage.

4. An inverter as claimed in any of claims 1 to 3 in combination with and connected to drive an induction motor, the derived control signal being fed to a motor speed control circuit.
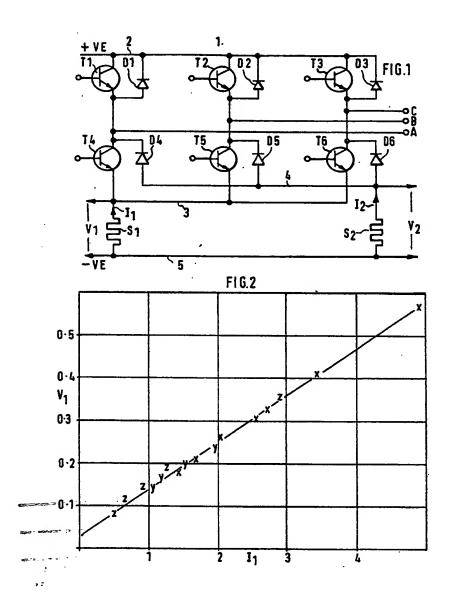
5. A D.C. to a.c. inverter substantially as described with reference to and as shown by Fig. 1 of the accompanying drawing.

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FIG.1

FIG.2

DOCKET NO: _2TP01P18004_

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